the present occasion the Director contents himself with a very short preface, but which gives evidence of the same untiring energy which marked the earlier volumes. For example, we are told that between 1891 and 1898 no less than 473,216 photometric settings were made with the meridian photometer, nearly all by the Director himself. The object of this heavy undertaking was to determine the magnitude of all stars brighter than 7·5 situated north of −40° declination. In the early days of magnitude work the Director did not propose to pass the limit of −30°. This restriction was perhaps necessary on account of the smaller photometer employed, but to overstep it may also indicate that the Director feels himself now competent to cope with the difficult questions arising from the extinction of light in our atmosphere. For, although the Durchmusterung does not aim at completeness beyond −40°, a good many stars, reaching to even within one degree of the Harvard horizon, have been included. Such measures are necessarily frequently discordant among themselves and do not agree with the estimates made in the southern hemisphere, but the discussion of all the discordant residuals, from whatever source arising, is deferred till the appearance of another volume. A difference of 0·65 mag. from the mean has been selected as marking the limit of discordant measures.

It will be noticed that this photometric survey covers no inconsiderable portion of the area that has been examined by Kapteyn. The whole of the first volume of the Cape Durchmusterung, −18° to −37°, is included, and should therefore furnish at once enlarged material for the examination of the systematic differences between photographic and visual magnitudes. Further, the meridian Pickering photometer is at present at the Arequipa Observatory, having been dismounted in September 1898, and the energetic Prof. Bailey is presumably using the same instrument at the southern station. Care has been taken to interchange the observers at Harvard so as to supply the means of reducing the observations on a uniform system, and thus continuing the Harvard survey to the Southern Pole. We may therefore look forward to the rapid acquisition of further data which will not only afford better values for the constants of reduction of the Cape plates, but exhibit in an unmistakable manner, though it may not solve, the perplexing difficulties to which we have alluded. Certainly, if energetic prosecution of the observations is of avail, the matter could not be in better hands than those of the Directors of Harvard and the Cape Observatories. W. E. P.

THE TREATMENT OF DISEASE BY LIGHT.

PHOTOTHERAPY, or the treatment of disease by light, has now, thanks to Prof. Finsen of Copenhagen, a recognised place in the domain of therapeutics. Finsen's first paper on the subject was published in 1893. In it he showed that the chemical or ultra-violet rays of the spectrum have a definite effect upon the course of small-pox, and he proposed that patients suffering from this disease should be kept in rooms from which the chemical rays of light were excluded by means of red curtains or red glass, in the same way that a photographer excludes these rays from his plates and paper. In an ordinary case of small-pox treated under the usual conditions, the eruption passes from the vesicular to the suppurative or pus-forming stage, and this condition is most marked upon the face and hands, the parts most exposed to light. It is in consequence of the destruction of the skin attendant upon the suppuration that the face and hands are so commonly the seat of hideous scars. Finsen's suggestion has been carried out with considerable success. In nearly every case in which the patient was kept in red light from the onset of the disease, there has been found to be a marked change in the course of the eruption. The suppuration and its attendant secondary fever have been almost, if not entirely, abolished, and as a result the patients recover with little, if any, scarring.

Finsen's next researches were made upon the action of light as an irritant, and they are of extreme interest to the biologist. It will suffice here to say that he found that the animal organism, especially in creatures which prefer to dwell in the dark, is markedly irritated by the chemical rays, while the other parts of the spectrum are non-irritant. From this he was led to investigate the effects of light upon bacteria. Here the field had already been occupied by Downes and Blunt, who, in 1878, in a paper read before the Royal Society, showed that the chemical rays are bactericidal. Duclaux, Arloing and others have worked upon the same lines and confirmed their results. It therefore seemed probable that superficial diseases of the skin caused by bacteria could be cured by the application of light. Of these, one of the most important and most intractable is lupus. Finsen, however, argued that the intensity of ordinary sunlight is obviously insufficient to kill the microbes as they lie in the skin, for lupus is particularly a disease of the face, which is more exposed to the sun than any other part. He therefore tried the effect of concentrating the light by means of lenses, cutting out the red and ultra-red rays by a blue medium. He found that cultures of micro-organisms *in vitro* were much more powerfully influenced by the concentrated rays. The sun's rays concentrated by the apparatus to be presently described were fifteen times stronger than ordinary sunlight. Powerful electric arc lights were also tried, and with a lamp of from 35 to 50 ampères the effect was similar to that of the sun, or even greater.

The next point to be determined was the penetrative power of light. For this purpose small sealed tubes containing silver salts were placed under the skin of animals and exposed to the concentrated light, and the silver was found to be blackened.

The effect of the blood circulating in the tissues was next demonstrated by a very ingenious experiment. A piece of photographic paper was placed behind the ear, and the outside of the lobule was exposed to the light. In about five minutes the paper was blackened. The experiment was then tried with the ear compressed between two pieces of glass so that it was rendered bloodless. The photographic paper was blackened by the light in twenty seconds. The absence of the red colouring matter of the blood allowed the chemical rays to penetrate with great ease.

The apparatus devised by Finsen for the treatment of lupus by the sun's rays (Fig. 1) consists of a large hollow planoconvex lens, filled with an ammoniacal solution of sulphate of copper and mounted upon a fork-like metal stand, so arranged that the lens can be moved about a horizontal and also round a vertical axis, and lowered and raised at will. The filtered sun's rays are focussed upon the area of skin to be treated, and at this spot is placed the compression apparatus. This is a very flat cylinder made of two plates of rock crystal fixed in a metal ring. Through the compression apparatus passes a current of cold water, so that the instrument is used to render the part to be treated bloodless and also to cool it. The pressure apparatus is held on the skin by a nurse throughout the whole sitting, which lasts one hour or a little more. The spot treated at each sitting is about the size of a sixpence.

The electric light apparatus (Fig. 2) is much larger and more complicated. Attached to a strong metal ring round a large arc lamp, of 30,000 to 35,000 candle-power, are four long cylinders like telescopes. Each telescope consists of two parts. The upper part, closed at each end by rock crystal lenses, makes the divergent rays of the arc light parallel, and the lower piece brings the rays thus

rendered parallel, to a focus on the skin of the patient. The lower part of the apparatus is filled with distilled water and is surrounded with a jacket through which cold water circulates. The compression apparatus used

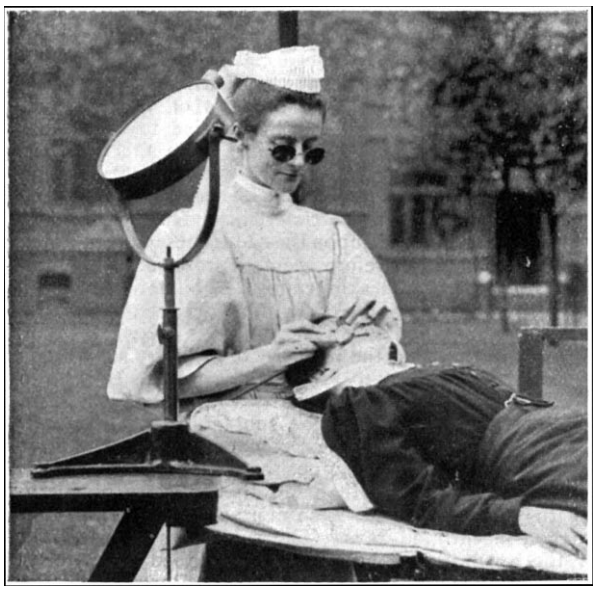

FIG. 1.—The treatment by sun-light

for the sun treatment is placed, as before, at the focus of the light to render the skin bloodless and to keep it cool. The length of the sitting is one hour. There is no blue solution in the electric light apparatus as now made, as it has been found in practice that the tube of distilled water and the circulating water in the pressure glass are sufficient to absorb the comparatively small amount of heat-rays given off by the arc light. Rock crystal lenses are used because ordinary crown glass prevents a great part of the chemical rays from passing through.

As a result of an hour's application of the light the skin may be a little red, but there is no proper reaction for from six to twelve hours, when there is definite redness and swelling and sometimes slight blistering. In from three to seven days all trace of reaction has usually disappeared, and the skin, though still hyperæmic, can be treated again if necessary. The process is repeated over the whole of the diseased area and especially at its margins, the most active parts, until every sign of lupus tissue has disappeared. If the disease is extensive, the treatment lasts many months. It must be noted that in many of the bad cases not only is the skin affected, but also the mucous membranes lining the mouth and nose, and these parts can very rarely be influenced by the light.

In Copenhagen there is a Light Institute under the direction of Prof. Finsen, and a very large number of patients, more than 500, have passed through the institution. It was in Copenhagen that the Queen saw the treatment, and Her Majesty was so impressed with the good results attained there that she graciously presented a set of the apparatus to the London Hospital a little more than a year ago. The demands upon that institution became so great that a second and a third lamp had to be put up, and even with these it is impossible to cope with the influx of patients from all parts of the British Isles, and even from such distant colonies as Newfoundland and New Zealand.

The drawbacks to the treatment are, first, the length of time which a severe case takes, and, secondly, the cost. Not only is there the cost of the electric light and the necessary maintenance, but every patient has to be attended by a nurse. At the London Hospital it has been found that it costs about 400*l.* or more a year to run one lamp, so that the light department there necessitates an expenditure of 1200*l.* a year. It is, therefore, gratifying to find that Mr. Alfred Harmsworth has come forward and endowed one lamp by a munificent gift of 10,000*l.*

It must be noted also that public spirit in Manchester and Liverpool will shortly provide for the installation of the light treatment in these cities.

The results in cases of ordinary lupus are excellent, provided that the patients can remain continuously under treatment for a sufficient length of time. The average of a large number of cases is three months. Certain other diseases, lupus erythematosus, rodent ulcer and alopecia areata, are influenced favourably by the light treatment. In the first mentioned disease the results are not nearly so striking as in the common form of lupus, but about one-third of the cases do well.

The light treatment has been too recently tried in London for any definite statement to be made as to the permanence of the results. In Copenhagen it has been in use for five years, and some of the earliest cases are quite free from recurrence to date.

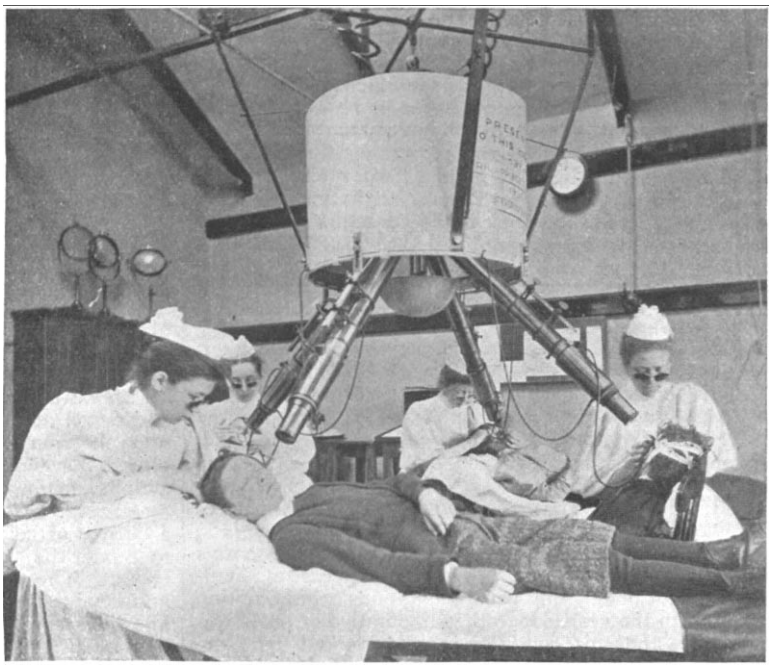

FIG. 2.—Treatment by electric light at the London Hospital.

The important advantages of this method of treatment over every other which has been used for lupus are that there is no destruction of tissue, there is no operation, and therefore no anæsthesia, for the treatment is pain-

less, and, last but not least, in a disease which attacks the face the cosmetic results are wonderful. The skin of the areas treated is soft, supple and pale, and in some cases so nearly resembles the healthy skin that it requires careful observation to detect the difference. As we have already mentioned, the drawbacks are the time and the expense, and the impossibility of treating the mucous surfaces. If a cheaper method of application, with shorter exposures and the possibility of treating a larger area at one sitting, is introduced, there is no doubt that the light treatment will be used in every hospital where a suitable electrical installation is obtainable.

NOTES.

WE deeply regret to record that Prof. P. G. Tait, late professor of natural philosophy in Edinburgh University, died on Thursday last, July 4, at seventy years of age.

A STATUE of Chevreul is to be unveiled to-day at the Paris Museum of Natural History.

THE death is announced of Prof. T. H. Safford, professor of astronomy in Williams College, Williamstown, Mass., U.S.A. Prof. Safford was born in 1836 and was renowned for his mathematical attainments as well as for his work in preparing catalogues of stars.

THE death of Sir Cuthbert Peek, at the early age of forty-six, will be regretted in scientific circles, for he was a liberal patron of scientific work as well as an active worker. He was interested in many branches of science, being a Fellow of the Royal Astronomical, Geographical, Meteorological and other Societies, and of the Anthropological Institute. He also served on the councils of several scientific societies. He maintained a well-equipped observatory at Rousdon, near Lyme Regis, Devon, and the meteorological and astronomical observations made there have frequently been referred to in these columns. Science can ill afford to lose one who was in such complete sympathy with its interests.

TIDINGS have been received of the death of Dr. Joseph Le Conte, professor of geology and natural history in the University of California. He was born in Georgia on February 26, 1823, and was a son of Dr. Lewis Le Conte, the botanist. Having studied for the medical profession, and taken the degree of M D. at New York in 1845, he settled at Macon as a physician. Science, and particularly geology, however, attracted much of his attention. In 1856 he was appointed professor of chemistry and geology in South Carolina College, and he resigned this post in 1869 for the professorship at San Francisco. He was the author of a useful work on the "Elements of Geology" (1878), of which a revised edition was issued in 1889, and he gave special attention to the study of volcanic and also of glacial phenomena.

THE International Association for the Advancement of Science, Arts and Education will hold its second international meeting at Glasgow in the University and in the International Exhibition from July 29 to September 27.

THE *Times* correspondent at St. Petersburg states that the Imperial Geographical Society is sending an expedition to the Pamir under the leadership of Dr. Fedshenko with the object of making geological, botanical and zoological researches.

THE Institution of Mining and Metallurgy announce the intention to award two premiums of twenty-five guineas each for the best papers on the comparative merits of circular and rectangular shafts respectively, for mines of great depth. An annual prize of ten guineas will also be awarded for the best paper upon any subject connected with the treatment of ore. Particulars can be obtained from the secretary of the Institution, Broad-street House, London, E.C.

A CORRESPONDENT sends us the following translation of an article which appeared in the *Neue Freie Presse* of Vienna, and was translated in the Copenhagen Journal *Dannebrog* on June 28, upon the removal of Tycho Brahe's remains from his tomb. This is the first report we have seen of the event :—"On the occasion of the 300th anniversary of Tycho Brahe's death the Prague Town Council decided to gather together the remains of the celebrated astronomer, which were in the Teyn Church, and bury them anew. Under the guidance of Mr. Herlein this operation was commenced yesterday. After having lifted the stone block on the monument, which is situated near the first column in the nave and which bears a full-length effigy of the great astronomer, a semi-collapsed arch was found, and on removing the stones two mouldering coffins were seen. On the following day a committee met to determine whether these bodies were those of Tycho Brahe and his wife. Two workmen with candles descended into the vault and removed the debris which covered the coffins, the wood of which was quite rotten and fell to pieces at every rough touch. About 10 a.m. the lid of the first coffin was free to be removed. It was a surprising sight that met the eye ; the body in the coffin was a wonderful likeness of the effigy on the monument. The head was slightly turned to one side, the bones of the face and the peaked Spanish beard being well preserved. The head was covered with a skull cap, and the neck was surrounded by a Spanish ruff which, like the remainder of the clothing, had suffered little during the 300 years since Tycho Brahe was laid in his last resting place. The feet were shod in long cavalry boots reaching up over the knee. That the body was Tycho Brahe's was also seen from the absence of the nose ; Tycho lost this organ in a duel and wore a silver one in its place. Amongst the rubbish was found a silver wreath and spray of flowers. The construction of the grave was rather remarkable, the stones being laid loosely over one another. This is all the more astonishing seeing Tycho Brahe was buried with great pomp and honours, but it is supposed that the vault broke down during the restoration of the church in 1721."

DR. C. D. WALCOTT, director of the U.S. Geological Survey, contributes to *Science* of June 29 a long article on the relations of the national Government to higher education and research. The U.S. Congress has generously aided technical and higher education by grants of land to States and territories for educational purposes. This policy was inaugurated in 1787, when a contract was entered into between the Ohio Company and the Board of Treasury of the United States, whereby lot 16 in every township was given for the maintenance of public schools and not more than two complete townships were given perpetually for the purpose of a university, the land to be applied to the purpose by the legislature of the State. The most important act, after that of 1787, was that of 1862, granting land for the endowment of colleges for teaching agriculture and the mechanical arts. The total grants of land amount to about 20,000 square miles, about 4000 square miles of which are for the establishment of higher institutions of learning, and 16,000 square miles are in aid of "colleges for the benefit of agriculture and the mechanical arts." In addition, Congress now grants annually to each of the forty-five States the sum of 5000*l.*, which is expended under the direction of State boards. The policy of the U.S. Government has thus been to relegate the direct control of education to the States, aiding them in this work by grants of land, and in the case of technical education by grants of money also. The Government has carried on original research for its own purposes in the district of Columbia, through